

**CLAIMS**

1. A method of non-invasively analysing skin structure, comprising  
5 the steps of:

- (i) irradiating a plurality of locations over an area of tissue under investigation and detecting the light remitted at each location;
- 10 (ii) analysing the light remitted at each location and obtaining a measurement representing the total melanin and dermal melanin within the tissue;
- (iii) comparing the measurement for the dermal melanin obtained in step (ii) with the measurement for the total melanin obtained in step (ii); and
- 15 (iv) using the comparison obtained in step (iii) to investigate the skin condition.

2. A method according to claim 1 where the dermal melanin measurement represents dermal melanin concentration.

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3. A method according to claim 1 where the dermal melanin measurement represents dermal melanin depth.

25 4. A method according to claim 1 where the dermal melanin measurement represents dermal melanin volume.

5. A method according to any preceding claim in which the dermal melanin measurement is shown as a false colour image.

6. A method according to any of any preceding claim in which an image is generated from the dermal melanin measurement made in step (ii).
- 5 7. A method according to claim 6 in which a texture measurement giving an indication of the texture of the image is calculated to give a measure of the total melanin.
- 10 8. A method according to claim 7 in which a standard deviation is used to calculate the texture of the image and provide a measure of the total melanin from the image.
9. A method according to any preceding claim in which an image is generated from the total melanin measurement made in step (ii).
- 15 10. A method according to claim 9 in which a texture measurement giving an indication of the texture of the image is calculated to give a measure of the dermal melanin..
- 20 11. A method according to claim 10 in which a standard deviation is used to calculate the texture of the image and provide a measure of the dermal melanin from the image.
- 25 12. A method according to claim 10 as it depends from claim 7 in which a comparison is made between the texture of the total melanin and the dermal melanin measurements.
13. A method according to claim 12 in which the comparison is made within regions where the dermal melanin is non-zero.

14. A method according to claim 12 or 13 where the comparison is made by utilizing a ratio of texture measurements.

5 15. A method according to any preceding claim which is used to infer information relating to skin malignancy.

16 A method according to any preceding claim in which step (ii) provides a spectral measurement over said plurality of locations.

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17. A method according to claim 16 which comprises mapping each spectral measurement into at least a two dimensional colour space.

15 18. A method according to claim 17 in which the two dimensions of the two dimensional colour space are arranged such that variations in blood concentration in the tissue have substantially no effect in that space.

19. A method according to claim 17 or 18 which comprises, for each spectral measurement, calculating:

20  $S(\rho_{ud}, \rho_{ld}, d_{ud}, d_{ld}, d_{l2}, d_{l3}, \phi, d_m) =$

$$\int_0^{\infty} R_{total}(\rho_{ud}, \rho_{ld}, d_{ud}, d_{ld}, d_{l2}, d_{l3}, \phi) \theta(\lambda, d_m)^2 S(\lambda) S_s(\lambda) d\lambda$$

where

$d_{l2}$  and  $d_{l3}$  are the depths of the

$d_{ud}$  and  $d_{ld}$  are the depths of the upper dermis and lower dermis respectively,

$\phi$  is the density of melanin.

20. A method according to claim 21 which comprises plotting  $S(\rho_{ud}, \rho_{ld}, d_{ud}, d_{ld}, d_{l2}, d_{l3}, \phi, d_m)$  in that space to provide a series of contours of increasing dermal melanin concentration at the papillary dermis depth.
- 5 21. A method according to claim 20 which comprises determining which contour is closest to the point represented by the spectral measurement; using that contour to provide an approximate value for  $fn$  (dermal melanin depth, dermal melanin concentration, epidermal concentration) for each location.
- 10 22. A method according to any of claims 16 to 21 in which the spectral measurements are calculated by calculating corrected colour co-ordinates for each location corresponding to a predetermined papillary dermis thickness.
- 15 23. A method according to any of claims 16 to 22 in which the spectral measurements are calibrated to eliminate effects due to variations in collagen concentration.
- 20 24. A method according to any claims 16 to 23, comprising the further step of making an array of  $fn$  values corresponding to each measurement location.
- 25 25. A method according to claim 24, for investigating a lesion upon tissue under investigation, comprising providing a second array of values of total melanin at each location, using said second array to measure the texture of the total melanin distribution (TTM); using said first array to measure the texture of the dermal melanin distribution (TDM), calculating the melanin texture ratio (MTR) for the lesion  $MTR = TDM/TTM$ .

26. A method according to claim 25, in which the MTR is compared with a threshold value to identify lesions with a high possibility of malignancy.
- 5 27. A method according to claim 25 or 26, in which the measurement of texture used for TTM is the same measure as used for TDM.
28. A method according to claim 27, in which the measurement of texture is by measuring the Standard deviation of the appropriate value.
- 10 29. A machine readable medium containing instructions which when read onto a machine cause that machine to perform the method of any preceding claim.
- 15 30. An apparatus arranged to non-invasively analyse the structure of skin comprising at least one light source arranged to irradiate the skin, a detector arranged to analyse light remitted from the skin to generate data representative of the remitted light and pass the data to a processor, the processor being arranged to process the data and obtain a measurement of the dermal melanin and the total melanin in the skin from the data and further arranged to make a comparison between the dermal melanin and the total melanin in order to infer determine the histology of the skin.
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